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AUTHOR Summers, Anita A.; Wolfe, Barbara L.
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ABSTRACT

This paper details a method for investigating the equity aspects of distributions within school districts of educational resources. To illustrate how to systematically examine in detail the allocation of school resources, the relationship between the distribution of a large number of resources among Philadelphia's public schools and the distribution of black and low-income pupils among the schools was determined. It is concluded that when plaintiffs use aggregate and few measurements (per pupil expenditures, for example), defendants and the courts will have little difficulty in establishing that proof that any particular pattern of resource distribution indicates the achievement of equality of educational opportunity. It is held that only the extent to which the allocation matches fiat--the district's public policies of allocation--can be demonstrated; if unequal resource allocations are found, then the source of the fiat must be determined. Finally, it is argued that what is clearly needed is matching well-defined objectives of a school system with well-defined evidence of which school inputs are most relevant for which type of student. (Author/JM)

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INTRADISTRICT DISTRIBUTION OF SCHOOL RESOURCES TO THE DISADVANTAGED: EVIDENCE FOR THE COURTS

By

Anita A. Summers
Barbara L. Wolfe

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ABSTRACT

This paper details a method for those interested in investigating the equity aspects of intradistrict distributions of educational resources. It should be viewed as a procedure for post Hobson v. Hansen lawyers which steps away from some of the speculative quality of the evidence that has been, and is still, being used. Using detailed individual school data in a systematic way allows the investigator to delineate which unequally distributed resources positively contribute to stated equity objectives, which resources are outside the school administration's control, and what the overall equity picture is, starting from the components. Using aggregate measures, such as per pupil expenditures in each school, does not permit this, and results in much debate on whether or not one particular component--school size, for example--explains away the expenditure variations. The method is applied to data for the Philadelphia School District.

Much has been written on the limitations of the statistical analysis of the now famous Hobson v. Hansen cases[1] in Washington, D. C.--cases which involved allegations of racial and income intradistrict discrimination in the allocation of school resources. In this article we detail a method for investigating the equity aspects of intradistrict distributions of educational inputs. This should also be viewed as a blueprint for post Hobson v. Hansen lawyers which steps away from some of the speculative quality of the evidence that has been used.

RESOURCE DISTRIBUTION AND EXPENDITURE EQUALIZATION

In the second round of Hobson v. Hansen, Judge J. Skelly Wright ruled that, for all elementary schools in the Washington, D. C. School District, "per pupil expenditures for all teachers' salaries and benefits . . . in any single elementary school . . . shall not deviate by more than 5 percent from the mean per pupil expenditure for all teachers' salaries and benefits at all elementary schools . . .."[2] Criticisms have been mainly leveled at the outdated income data used to characterize the schools and the nondiscriminatory reasons why salary

[1]Hobson v. Hansen, 269 F. Supp. 401 (D. D. C. 1967), affirmed sub nom., Smuck v. Hobson, 408 F. 2d 175 (D. C. ar. 1969), Hobson v. Hansen, 327 F. Supp. 844 (D. D. C. 1971).

[2]Ibid., 327 F. Supp. 844 (D. D. C. 1971) at 863.

expenditures might vary by more than 5 percent. It seems to us that, more imperative, than dissecting the issue of the relationship between size of school and expenditures per pupil[3] (a major explanation given for nondiscriminatory variation in expenditures) is increasing the number of resources that can be examined in a systematic way in an urban school district.

In the most recent on-going case involving intradistrict equalization, Brown v. Chicago Board of Education,[4] expenditures are still being looked at in terms of aggregate expenditures, though a cursory swipe has been made at some detail. Wherever individual school data exist, much deductive testimony can be readily replaced by something closer to the facts.[5]

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[3]Both plaintiffs ("A Research Report for Plaintiffs," Appendix C to Plaintiff's Memorandum, Dec. 8, 1970 by Stephen Michelson) and defendants ("Defendants' Reply Memorandum to the Court," January 18, 1971 by Dave M. O'Neill, Burton Gray, and Stanley A. Horowitz) addressed themselves to this question.

[4]Dusharn L. Brown, et al. v. Board of Education of the City of Chicago and James F. Redmond, in U. S. District Court for the Northern District of Illinois Eastern Division, Civil Action No. 71 C 694, Brief in Support of Plaintiffs' Motion for Preliminary Injunction, June 28, 1971.

[5]Ibid., p. 9. In discussing possible causes of differences in per pupil expenditures among schools, the plaintiffs' brief states: "For example, it is conceded that many schools in rapidly growing, and presumably Black neighborhoods have no library facilities at all, whereas schools in stable, White, middle-class neighborhoods, almost invariably, have such facilities . . .. In such situations, it seems apparent that the expenditures for library books will be much greater in the White, middle-class schools." Appropriate examination of the detailed data would allow a decisive description of the relationship between density of Black students and library facilities. We found, in Philadelphia, that the distribution of library resources was unrelated to the distribution of Black or low-income pupils, with one exception--more library books per pupil were available in elementary schools with more low-income students.

To illustrate the benefits and efficacy of a systematic and detailed examination of the allocation of school resources, we have looked at the School District of Philadelphia--that is, we have looked at the relationship between the distribution among Philadelphia's public schools of a large number of resources (including measurements of the quality of teachers and principals) and the distribution among the schools of the proportion of Black and the proportion of low-income pupils. In Section II we indicate the limitations in considering equalization of educational opportunity issues from the resource allocation aspect alone, no matter how detailed the resources. In Section III the data and statistical procedures are described. In Section IV the empirical results for the Philadelphia School District are laid out and summarized. Section V is a statement of what can be learned from the resource allocation procedure described in the article.

RESOURCE DISTRIBUTION AND EQUALITY OF OPPORTUNITY

Even a close look at the distribution of resources to the disadvantaged cannot resolve the question of whether educational opportunity is equal for all. It is not at all obvious what the relationship is between resource allocation and educational growth.

First, in certain obvious instances, we recognize that equal resource input does not produce equal output. More resources are required to educate blind children than to educate sighted children. Similarly, equal resources to those with socioeconomic disadvantages and those without would not represent equal educational opportunity.

A close look at resource allocation to the disadvantaged can only tell one the state of the system--it does not answer the question of whether or not this state coincides with views of what constitutes equity. To answer this question, two further steps are required: (1) a definition by parents, courts and/or legislators of what constitutes equity, and (2) a knowledge of what is required to bring about this state of equity.

A second issue, therefore, is that, even if agreement is reached on what might measure educational opportunity (A minimal goal such as all students increasing their grade equivalent test scores by an amount equal to the number of grades of schooling? A more aggressive goal of increasing all students who start below grade level to grade level after a specified number of years of schooling?) we need to know what can bring this about. We need to know what package of school inputs is required for each type of student to equip him or her for educational growth. It is these inputs, and only these inputs--if they can be identified--whose allocation should be examined to assess a school district's equalization efforts. This package, however, is not clearly identifiable in the present state of the arts.

A third point further limits the inferences that should be drawn about a school district's culpability from resource allocation data. Some kinds of inputs, it should be recognized, are not controllable by the central administration. Expenditures on plant maintenance are determined annually, but the age of school buildings is not. Urban school administrations are saddled with variations

among city schools in the age of the plant facilities and in vandalism problems. Both of these burdens mean an unequal distribution of plant maintenance expenditures to obtain an equal distribution of plant quality. This unequal input distribution is, presumably, closer to equity objectives than an equal distribution, as is the case with compensatory funds.

Further, the characteristics of the teachers' labor market in urban school districts--an identical wage structure in all schools and seniority transfer rights--mean that "better" teachers are likely to be found in "better" schools. If this outcome is not consistent with equity objectives, then, perhaps, unions should be joined with superintendents of schools as defendants.

Since we are without adequate knowledge relating just which inputs affect output, and without a fully defined concept of equality of educational opportunity, parents, courts, and legislators are continuing to look at school inputs to keep tabs. As acceptors of second best they are in good company--gross national product accountants value the services of policemen, ministers, and others at input cost, not output values.

But, as acceptors of second best, it becomes essential to recognize which unequally distributed resources contribute to achieving equity objectives, which resources are outside a school district's control, and what the overall picture is from looking at all individual resources separately. Only then is it possible to get some notion of the consistency of the resource allocation with equity objectives, and to put the finger on the relevant sinner.

THE MEASUREMENT OF RESOURCE DISTRIBUTION

Our recommended objective in measuring resource distribution is to obtain the maximum amount of data on resources available by individual schools. We did this for the Philadelphia School District.

Whenever possible, physical measurements of resources are used: the number of pupils per science laboratory, the number of library books, and the condition of the school building are examples. Expenditure figures, obviously less desirable since they do not distinguish quality from quantity variations (this is the issue raised by the choice of per pupil expenditure on teachers' salaries as the criterion in Hobson v. Hansen) are used when these are not available. In addition, a third, and unique type of data, was available to us--measurements of teacher "quality" in each school. Averages of these for all teachers were calculated for each school in the Philadelphia School District: the step number (equivalent to experience) of each teacher, the number of years of education of each teacher, the Gourman[6] rating of the undergraduate college each teacher attended, and the score of each teacher in the National Teacher's Common Examination.

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[6]The Gourman rating was published in The Gourman Report (Phoenix, Arizona: The Continuing Education Institute, 1967), authored by Jack Gourman. It is a rating based on the undergraduate programs of nearly all colleges and universities in the United States, with information drawn from professional societies, commercial publications, foundations, etc., as well as the institutions themselves. The areas rated include (1) individual departments, (2) administration, (3) faculty (including student/staff ratio and research), (4) student services (including financial aid and honor programs), and (5) general areas such as facilities and alumni support. The Gourman rating is a simple average of all of these.

Resources are classified in three ways: (1) Intended to be Neutral. These are resources which are intended to be distributed in a manner unrelated to the proportion of disadvantaged pupils. The School District does not, for example, intend that the number of pupils per teacher or expenditures per pupil on kindergarten to be determined by the proportion of Black or low-income pupils. (2) Intended to be Compensatory. These are resources which are intended to go to particular groups of students to "compensate" them for their socioeconomic handicaps. Thus, Federal funds are primarily intended to go to the poor, and remedial education to those disadvantaged by minimal preschool motivation and education. (3) The World as It Is. There are many characteristics of the school environment, over which the school administration has, in any immediate sense, little control and impact--the age of the school and the number of disruptive incidents are examples.

We consider it worthwhile to distinguish between different levels of schooling, since input impact is regarded as differing by age level. Compensatory funding, for example, is poured most heavily into elementary school students. Data for 185 elementary schools, 34 junior high schools, and 22 senior high schools in Philadelphia are analyzed. Linear regressions are used to relate the distribution of resources to the proportion of Black students and to the proportion of low-income students.[7] The relationship

[7]The proportion of low-income students in a school is defined as the proportion of students eligible for the free lunch program, which was the basis for the allocation of most of the federally funded programs. We have, in addition, calculated the low-income

is explored through the use of the regressions defined by equations (1) and (2):

$$(1)\quad z_i^j = \alpha^j x_{1i} + \beta^j + u_i^j$$

$$(2)\quad z_i^j = \gamma^j x_{2i} + \delta^j + v_i^j$$

$$i=1, \ldots, N \qquad j=1, \ldots, P$$

where z_i^j refers to the quantity of the jth resource or condition in the ith school, x_{1i} is the proportion of Black students in the ith school, and x_{2i} is the proportion of low-income students in the ith school.

The results in Tables I and II (for elementary schools), Tables III and IV (for junior high schools), and Tables V and VI (for senior high schools) are classified as to whether or not the direction of the distribution was compensatory (more to the disadvantaged). This allows a ready comparison between intent and result.

A neat statistic for summing up all of the individual findings would simplify the problems of drawing conclusions as to whether "discrimination" exists and equity is being served. But no such overall summary statistic exists, and the conclusions must flow from the statistical significance of separate calculations and a judgment about the weight of evidence.

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regressions using school feeder area income estimates. These estimates were derived by a weighted average of income estimates for the blocks in each feeder area. The block income estimates, in turn, were calculated using a procedure combining block housing data and tract income distribution data. The procedure is fully explained, with an accompanying computer program package, in a forthcoming manual to be published by the Federal Reserve Bank of Philadelphia.

RESOURCE DISTRIBUTION: THE FACTS

Interpretation of Tables. The results are laid out in Tables I-VI. The code for the variables is listed at the end of the article. The t-ratios are specified for each of the resources. They are placed, in accordance with the sign and the nature of the resource, in the compensatory (Column 4) or countercompensatory column (Column 5). Asterisks indicate the results which are significant at the .05 percent level. The $\bar{X}$, σ, and R^2 are given in Columns 2, 3, and 8. The coefficients are expressed in units reflecting the difference between being in a school that had 100 percent Blacks or 100 percent low-income pupils (Column 6). Finally, to give some notion of the impact of these differences, the coefficients are expressed as percentages of the mean of the variable (Column 7).

Consider in Table I, for example, the question of the distribution of principals' experience in relation to the distribution of Black students at the elementary school level. In Column 1, principal experience is listed as EXPER, P. In Column 2, the mean years of experience is seen to be 8.52 years, and in Column 3, the standard deviation around the mean is seen to be 7.04 years. The proportion of variability in the experience of principals "explained" by the variation in the proportion of Black students, R^2, is seen in Column 8 to be 13 percent. The negative sign of the coefficient is indicated with the sign associated with the t-statistic in Column 5--that is, the years of experience of the principal decline significantly (indicated by the asterisk) as the proportion of

TABLE I

Elementary School Resources and Conditions in Philadelphia, 1970-71, in Relation to the Distribution of Black Pupils

$$z_i^j = \alpha^j x_{ii} + \beta^j + u_i^j$$

(1) Variable	(2) $\bar{X}$	(3) σ	(4) Compensatory[1]	(5) Counter-Compensatory[1]	(6) 0 to 100% Blacks[2]	(7) (6) as % of $\bar{X}$	(8) R^2
Resources Intended to be Neutral							
PUPCOST	$ 536.24	$ 93.12	+2.250*		+$ 38.49	7.18	.022
SALARY	$ 463.71	$ 78.04	+2.607*		+$ 37.19	8.02	.031
CLERICAL	$ 42.55	$ 11.27	+2.104*		+$ 4.37	10.27	.018
NONTEACH	279.24	180.83		+ 0.757	+ 25.43	9.11	†
PUPRATIO	27.75	3.97	-4.757*		- 3.32	11.96	.105
KINDER	$ 31.13	$ 14.02	+2.234*		+$ 29.94	96.18	.022
GRADE 1-3	$ 370.87	$ 80.24	+1.877		+$ 22.61	6.10	.014
GRADE 4	$ 358.05	$ 95.43	+0.578		+$ 9.86	2.75	†
GRADE 5	$ 336.27	$ 105.13		- 1.427	-$ 26.65	7.93	.006
GRADE 6	$ 324.28	$ 115.62	+0.076		+$ 1.70	0.52	†
LIBRARY	$ 4.74	$ 5.14		- 0.514	-$ 0.49	10.34	†
BOOKS	8.05	2.92	+1.002		+ 0.54	6.71	†
PLAY	53.63	50.33		- 3.240*	- 29.53	55.06	.049
ART	$ 1.87	$ 3.74		- 1.693	-$ 1.18	63.10	.010
MUSIC	$ 8.86	$ 6.78		- 2.144*	-$ 2.67	30.14	.019
HEALTH	$ 9.63	$ 6.31	+0.245		+$ 0.29	3.01	†
PLANT	$ 56.51	$ 16.23		- 0.474	-$ 1.43	2.53	†
CONDITION	2.98	0.90		- 0.230	0.00	0.00	†
CAPACITY	93.75%	32.44%		+ 2.267*	+ 22.22%	23.70	.022
% VACANT	2.63%	3.70%		+ 3.386*	+ 1.50%	57.03	.070
EXPTEACH	7.36	1.16	+0.652		+ 0.14	1.90	†
EXAMTEACH	607.09	20.40		- 4.370*	- 15.52	2.56	.089
EDUCTEACH	1.86	0.15		- 2.195*	- 0.06	3.32	.020
SCHOOLTEA	406.05	24.82		- 7.858*	- 30.86	7.60	.248
DEGREES, P	1.02	0.24	+0.404		+ 0.02	1.96	†
EXPER, P	8.52	7.04		- 5.347*	- 6.40	75.12	.130
CREDITS, P	2.06	1.65	+1.177		+ 0.35	16.99	.002
Resources Intended to be Compensatory							
REMEDIAL	$ 16.00	$ 9.10	+3.475*		+$ 5.90	36.88	.057
COUNSEL	$ 16.56	$ 6.42	+0.900		+$ 1.07	6.46	†
IMPROVE	$3,010.75	$6,907.59	+5.019*		+$6,051.69	201.00	.116
FEDFUNDS	$ 75.62	$ 262.19	+4.921*		+$ 91.39	120.85	.112
The World as It Is							
DATE	1933	22.92	+0.180		+ 0.77	0.04	†
% ATTEND	85.94%	4.35%	+1.345		+ 1.91%	2.22	.004
% HIGH	6.18%	8.08%		- 7.308*	- 9.68%	156.63	.222
% LOW	47.23%	21.02%		+10.716*	+ 32.87%	69.60	.382
DISRUPT	3.07	3.00		+ 5.864*	+ 3.00	97.72	.154

*Significant at the .05 level.

†$R^2 < .010$

[1] $t = \hat{a}/\hat{\sigma}_{\hat{a}}$

[2] $a^j \cdot 100$

TABLE II

Elementary School Resources and Conditions in Philadelphia, 1970-71, In Relation to the Distribution of Low-Income Pupils

$$E_i^j = \gamma^j X_{2i} + \delta^j + v_i^j$$

(1) Variable	(2) $\bar{X}$	(3) σ	(4) Compensatory[1]	(5) Counter-Compensatory[1]	(6) 0 to 100% Low-Income[2]	(7) (6) as % of $\bar{X}$	(8) R^2
Resources Intended to be Neutral							
PUPCOST	$ 536.24	$ 93.12	+3.445*		+$ 68.86	12.84	.056
SALARY	$ 463.71	$ 78.04	+3.462*		+$ 57.98	12.50	.056
CLERICAL	$ 42.55	$ 11.27	+2.924*		+$ 7.15	16.80	.039
NONTEACH	279.24	180.83	-0.564		- 22.57	8.08	†
PUPRATIO	27.75	3.97	-5.865*		- 4.73	17.05	.154
KINDER	$ 31.13	$ 14.02	+2.392*		+$ 38.11	122.42	.025
GRADE 1-3	$ 370.87	$ 80.24	+3.021*		+$ 42.71	11.52	.043
GRADE 4	$ 358.05	$ 95.43	+1.099		+$ 24.85	6.94	.001
GRADE 5	$ 336.27	$ 105.13		- .775	-$ 17.19	5.11	†
GRADE 6	$ 324.28	$ 115.62		- 1.444	-$ 37.80	11.66	.006
LIBRARY	$ 4.74	$ 5.14		- 0.676	-$ 0.77	16.24	†
BOOKS	8.05	2.92	+3.397*		+ 2.13	26.46	.054
PLAY	53.63	50.33		- 3.692*	- 39.72	74.06	.064
ART	$ 1.87	$ 3.74		- 0.921	-$ 0.77	41.18	†
MUSIC	$ 8.86	$ 6.78		- 1.611	-$ 2.40	27.09	.009
HEALTH	$ 9.63	$ 6.31	+0.163		+$ 0.23	2.39	†
PLANT	$ 56.51	$ 16.23	+2.520*		+$ 8.91	15.77	.028
CONDITION	2.98	0.90		- 0.706	- 0.14	4.70	†
CAPACITY	93.75%	32.44%		+ 4.202*	+ 47.43%	50.59	.083
% VACANT	2.63%	3.70%		+ 4.502*	+ 2.10%	79.84	.095
EXPTEACH	7.36	1.16		- 1.479	- 0.38	5.16	.006
EXAMTEACH	607.09	20.40		- 2.106*	- 9.41	1.55	.018
EDUCTEACH	1.86	0.15		- 2.449*	- 0.08	4.30	.026
SCHOOLTEA	406.05	24.82		- 5.028*	- 25.92	6.38	.116
DEGREES, P	1.02	0.24		- 0.495	- 0.02	1.96	†
EXPER, P	8.52	7.04		- 4.066*	- 6.07	71.24	.078
CREDITS, P	2.06	1.65		- 0.094	- 0.03	1.46	†
Resources Intended to be Compensatory							
REMEDIAL	$ 16.00	$ 9.10	+2.814*		+$ 5.75	35.94	.036
COUNSEL	$ 16.56	$ 6.42	+1.938		+$ 2.72	16.43	.015
IMPROVE	$3,010.75	$6,907.59	+4.728*		+$6,830.53	226.87	.104
FEDFUNDS	$ 75.62	$ 262.19	+6.152*		+ 131.67	174.12	.167
The World As It Is							
DATE	1933	22.92		- 0.202	- 1.03	0.05	†
% ATTEND	85.94%	4.35%	+0.360		+ 0.61%	0.71	†
% HIGH	6.18%	8.08%		- 8.857*	- 13.27%	214.72	.296
% LOW	47.23%	21.02%		+11.482*	+ 40.76%	86.30	.416
DISRUPT	3.07	3.00		+ 3.206*	+ 2.08	67.75	.048

*Significant at the .05 level.

†$R^2 < .010$

[1] $t = \hat{\gamma}/\hat{\sigma}_{\hat{\gamma}}$

[2] $\gamma^j \cdot 100$

TABLE III

Junior High School Resources and Conditions in Philadelphia 1970-71, In Relation to the Distribution of Black Pupils

$$z_i^j = \alpha^j x_{1i} + \beta^j + u_i^j$$

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	$\bar{X}$	σ	Compensatory[1]	Counter-Compensatory[2]	0 to 100% Blacks	(6) as % of $\bar{X}$	R^2
Resources Intended to be Neutral							
PUPCOST	$732.96	$108.29	+0.961		+$ 50.80	6.93	†
SALARY	$638.02	$ 87.62	+0.752		+$ 32.33	5.07	†
CLERICAL	$ 57.26	$ 17.07	+1.825		+$ 15.70	27.42	.066
NONTEACH	392.68	285.46	-0.416		- 41.65	10.61	†
PUPRATIO	20.93	2.14	-3.108*		- 2.88	13.76	.208
LIBRARY	$ 10.64	$ 5.68		-0.039	-$ 0.11	1.03	†
BOOKS	7.50	2.88	+0.798		- 1.13	15.07	†
LABS, EN	265.57	219.18		+1.019	+ 108.84	40.98	.001
LABS, AT	223.99	180.45		+0.959	+ 84.50	37.72	†
ART	$ 25.60	$ 4.58	+0.115		+$ 0.34	1.33	†
MUSIC	$ 16.65	$ 5.91		-0.731	-$ 2.17	13.03	†
HEALTH	$ 40.04	$ 7.91	+0.530		+$ 2.29	5.72	†
PLANT	$ 78.51	$ 27.99	+1.076		+$ 14.66	18.67	.005
CONDITION	3.12	0.58		-1.289	- 0.40	12.82	.021
CAPACITY	93.11%	35.72%		+1.876	+ 36.77%	39.49	.071
% VACANT	4.63%	3.41%		+6.833*	+ 8.02%	173.22	.581
EXPTEACH	6.90	1.17		-2.662*	- 1.38	20.00	.156
EXAMTEACH	620.63	15.37		-4.882*	- 27.84	4.49	.409
EDUCTEACH	1.91	0.11		-2.604*	- 0.12	6.28	.149
SCHOOLTEA	420.59	18.79		-2.037*	- 17.64	4.19	.087
DEGREES, P	0.97	0.17		0.000	0.00	0.00	†
EXPER, P	5.00	6.31		-2.791*	- 7.73	154.60	.171
CREDITS, P	2.15	1.48	+0.119		+ 0.09	4.19	†
Resources Intended to be Compensatory							
REMEDIAL	$ 15.72	$ 9.22	+2.537*		+$ 10.94	69.59	.141
COUNSEL	$ 31.06	$ 5.69	+1.683		+$ 5.82	18.74	.053
FEDFUNDS	$ 23.90	$ 64.85		-0.747	-$ 23.78	99.50	†
The World As It Is							
DATE	1932	16.17		-0.318	- 2.69	0.14	†
% ATTEND	79.41%	5.39%		-0.263	- 0.70%	0.88	†
% HIGH	4.29%	7.38%		-3.412*	- 10.68%	248.95	.244
% LOW	49.74%	21.60%		+5.968*	+ 43.91%	88.28	.512
DISRUPT	10.38	6.79		+1.535	+ 4.98	47.98	.040

*Significant at the .05 level.

†$R^2 < .010$.

[1] $t = \hat{\alpha}/\hat{\sigma}_{\hat{\alpha}}$.

[2] $\alpha^j \cdot 100$.

TABLE IV

Junior High School Resources and Conditions in Philadelphia, 1970-71, in Relation to the Distribution of Low-Income Pupils

$$\hat{Y}_i^j = \gamma^j X_{1i} + \delta^j + v_i^j$$

(1) Variable	(2) $\bar{X}$	(3) σ	(4) Compensatory[1]	(5) Counter-Compensatory[1]	(6) 0 to 100% Low-Income[2]	(7) (6) as % of $\bar{X}$	(8) R^2
Resources Intended to be Neutral							
PUPCOST	$732.96	$108.29	+0.956		+$ 51.93	7.08	†
SALARY	$638.02	$ 87.62	+0.326		+$ 14.50	2.27	†
CLERICAL	$ 57.26	$ 17.07	+1.377		+$ 12.43	21.71	.026
NONTEACH	392.68	285.46		+0.190	+ 27.57	7.02	†
PUPRATIO	20.93	2.14	-1.901		- 1.96	9.36	.073
LIBRARY	$ 10.64	$ 5.68		-1.661	-$ 4.73	44.45	.051
BOOKS	7.50	2.88	+0.507		+ 0.73	9.73	†
LABS, EN	265.57	219.18		+2.209*	+ 229.42	86.39	.105
LABS, AT	223.99	180.45		+2.069*	+ 178.40	79.65	.091
ART	$ 25.60	$ 4.58	+0.437		+$ 1.30	5.08	†
MUSIC	$ 16.65	$ 5.91		-0.608	-$ 1.86	11.17	†
HEALTH	$ 40.04	$ 7.91	+0.190		+$ 0.85	2.12	†
PLANT	$ 78.51	$ 27.99	+1.178		+$ 16.42	20.91	.012
CONDITION	3.12	0.58		-1.649	- 0.49	15.71	.052
CAPACITY	93.11%	35.72%		+1.734	+ 35.17%	37.77	.058
% VACANT	4.63%	3.41%		+3.721*	+ 5.88%	127.00	.280
EXPTEACH	6.90	1.17		-0.896	- 0.53	7.68	†
EXAMTEACH	620.63	15.37		-2.388*	- 17.20	2.77	.125
EDUCTEACH	1.91	0.11		-2.942*	- 0.14	7.33	.188
SCHOOLTEA	420.59	18.79		-3.015*	- 25.43	6.05	.197
DEGREES, P	0.97	0.17	+1.304		+ 0.15	15.04	.021
EXPER, P	5.00	6.31		-2.345*	- 6.95	139.00	.120
CREDITS, P	2.15	1.48	+0.382		+ 0.29	13.49	†
Resources Intended to be Compensatory							
REMEDIAL	$ 15.72	$ 9.22	+1.731		+$ 8.03	51.08	.057
COUNSEL	$ 31.06	$ 5.69	+2.237*		+$ 7.71	24.82	.108
FEDFUNDS	$ 23.90	$ 64.85	+0.391		+$ 12.86	53.81	†
The World as It Is							
DATE	1932	16.17		-0.774	- 6.35	0.32	†
% ATTEND	79.41%	5.39%		-0.349	- 0.95%	1.20	†
% HIGH	4.29%	7.38%		-4.625*	- 13.45%	313.52	.382
% LOW	49.74%	21.60%		+7.244*	+ 48.99%	98.49	.609
DISRUPT	10.38	6.79		+1.509	+ 5.03	48.46	.037

*Significant at the .05 level.

†$R^2 < .010$

[1] $t = \hat{\gamma}/\hat{\sigma}_{\hat{\gamma}}$

[2] $\gamma^j \cdot 100$

TABLE V

Senior High School Resources and Conditions in Philadelphia, 1970-71, in Relation to the Distribution of Black Pupils

$$z_i^j = \alpha^j x_{1i} + \beta^j + u_i^j$$

(1) Variable	(2) $\bar{X}$	(3) σ	(4) Compensatory[1]	(5) Counter-Compensatory[1]	(6) 0 to 100% Blacks[2]	(7) (6) as % of $\bar{X}$	(8) R^2
Resources Intended to be Neutral							
PUPCOST	$879.86	$172.88	+0.674		+$ 73.58	8.36	†
SALARY	$751.37	$136.98	+0.567		+$ 49.24	6.55	†
CLERICAL	$106.57	$ 35.86	+0.907		+$ 22.15	20.78	†
NONTEACH	374.86	244.84		+0.993	+ 151.62	40.45	†
PUPRATIO	21.00	2.66	-1.086		- 1.79	8.52	.008
LIBRARY	$ 9.16	$ 4.39		-0.042	-$ 0.12	1.31	†
BOOKS	7.77	4.25		-0.117	- 0.32	4.12	†
LABS, EN	137.45	42.32		-0.240	+ 6.49	4.72	†
LABS, AT	107.94	36.76	-1.258		- 2.84	2.63	.027
ART	$ 9.07	$ 4.62	+0.765		+$ 2.22	24.48	†
MUSIC	$ 11.08	$ 4.44	+1.274		+$ 3.39	30.60	.030
HEALTH	$ 51.71	$ 10.60		-0.057	-$ 0.40	0.77	†
PLANT	$ 95.12	$ 27.15	+0.723		+$ 12.40	13.04	†
CONDITION	3.14	0.76		-2.570*	- 1.08	34.39	.211
CAPACITY	97.58%	21.87%		+0.386	+ 9.81%	10.05	†
% VACANT	2.25%	2.78%		+3.301*	+ 2.08%	.92	.320
EXPTEACH	8.24	0.79		-3.333*	- 1.36	16.50	.325
EXAMTEACH	636.61	15.19		-1.503	- 13.83	2.17	.057
EDUCTEACH	1.80	0.21		-2.088*	- 0.25	13.89	.138
SCHOOLTEA	451.38	16.70		-0.813	- 8.53	1.89	†
DEGREES, P	1.23	0.42	+0.187		+ 0.05	4.07	†
EXPER, P	5.00	3.81	+0.075		+ 0.18	3.60	†
CREDITS, P	3.00	2.22		-0.208	- 0.29	9.67	†
Resources Intended to be Compensatory							
REMEDIAL	$ 13.58	$ 8.30	+3.735*		+$ 15.38	113.25	.382
COUNSEL	$ 35.22	$ 4.47	+2.302*		+$ 8.86	25.16	.170
FEDFUNDS	$ 28.36	$ 22.90	+3.617*		+$ 41.15	145.10	.365
The World as It Is							
DATE	1935	17.91		-2.261*	- 23.08	1.19	.164
% ATTEND	71.32%	9.24%		-4.549*	- 18.83%	26.40	.484
DISRUPT	14.73	11.53		+2.145*	+ 14.26	96.81	.146

*Significant at the .05 level.

†$R^2 < .010$

[1] $t = \hat{\alpha}/\hat{\sigma}_{\hat{\alpha}}$

[2] $\alpha^j \cdot 100$

TABLE VI

Senior High School Resources and Conditions in Philadelphia, 1970-71, in Relation to the Distribution of Low Income Pupils

$$z_i^j = \gamma^j x_{21} + \delta^j v_i^j$$

(1) Variable	(2) $\bar{X}$	(3) σ	(4) Compensatory[1]	(5) Counter-Compensatory[1]	(6) 0 to 100% Low Income[2]	(7) (6) as % of $\bar{X}$	(8) R^2
Resources Intended to be Neutral							
PUPCOST	$879.86	$172.88	+1.067		+$140.51	15.97	.006
SALARY	$751.37	$136.98	+0.903		+$ 94.94	12.64	†
CLERICAL	$106.57	$ 35.86	+1.324		+$ 38.79	36.40	.035
NONTEACH	374.86	244.84	-0.152		- 29.18	7.78	†
PUPRATIO	21.00	2.66	-1.485		- 2.94	14.00	.054
LIBRARY	$ 9.16	$ 4.39		-0.316	-$ 1.14	12.45	†
BOOKS	7.77	4.25		-0.264	- 0.88	11.33	†
LABS, EN	137.45	42.32		+0.237	+ 7.83	5.70	†
LABS, AT	107.94	36.76	-1.351		- 37.24	34.50	.038
ART	$ 9.07	$ 4.62		-0.147	-$ 0.54	5.95	†
MUSIC	$ 11.08	$ 4.44	-2.214*		+$ 6.89	62.18	.163
HEALTH	$ 51.71	$ 10.60		-0.253	-$ 2.15	4.16	†
PLANT	$ 95.12	$ 27.15	+1.592		+$ 31.90	33.54	.068
CONDITION	3.14	0.76		-3.284*	- 1.57	50.00	.318
CAPACITY	97.58%	21.87%		+0.008	+ 0.25%	0.26	†
% VACANT	2.25%	2.78%		+2.356*	+ 2.00%	0.89	.178
EXPTEACH	8.24	0.79		-1.868	- 1.07	12.99	.106
EXAMTEACH	636.61	15.19		-2.386*	- 25.05	3.93	.183
EDUCTEACH	1.80	0.21		-2.236*	- 0.32	17.78	.160
SCHOOLTEA	451.38	16.70		-1.419	- 17.69	3.92	.046
DEGREES, P	1.23	0.42		-0.594	- 0.19	15.45	†
EXPER, P	5.00	3.81		-0.116	- 0.35	7.00	†
CREDITS, P	3.00	2.22		-0.878	- 1.50	50.00	†
Resources Intended to be Compensatory							
REMEDIAL	$ 13.58	$ 8.30	+2.523*		+$ 14.44	106.33	.203
COUNSEL	$ 35.22	$ 4.47	+1.418		+$ 7.18	20.39	.046
FEDFUNDS	$ 28.36	$ 22.90	+4.325*		+$ 55.78	196.69	.457
The World as It Is							
DATE	1935	17.91		-2.387*	- 29.54	1.53	.183
% ATTEND	71.32%	9.24%		-4.010*	- 21.62%	30.31	.418
DISRUPT	14.73	11.53		+1.229	- 10.69	72.57	.024

*Significant at the .05 level.

†$R^2 < .010$

[1] $t = \hat{\gamma}/\hat{\sigma}_{\hat{\gamma}}$

[2] $\gamma^j \cdot 100$

Blacks in elementary schools increases. A pupil in a school with all Blacks is likely to face a principal whose experience is 6.4 years less (Column 6) than a pupil in a school with no Blacks. The negative coefficient associated with a 1 percentage point change in the proportion of Blacks, -.0640, is multiplied by 100 to obtain this value. How "big" is a 6.4 variation? Some notion of this can be obtained by comparing this range with the $\bar{X}$. Thus, in Column 7, the entry of 75.12 percent indicates that the variation in principal experience as one moves from an all Black to an all non-Black school is substantial--over 75 percent of the mean number of years of principal experience, 8.52 years.

It is clear that, unlike statisticians, school administrators would sigh with relief at seeing a line of daggers ($R^2 < .010$) in the R^2 column for neutrally intended resources and no asterisks with the t-values!

Elementary Schools. (Detailed findings are in Tables I and II.) Schools with higher proportions of Black students (Table I) had some neutrally intended resources delivered in a significantly compensatory direction--total cost per pupil, instructional salary costs, clerical expenditures, number of pupils per teacher, kindergarten expenditures (Column 4). The average increase in expenditures per kindergarten pupil between an all Black school and an all non-Black school was about equal to the average expenditures (Column 7, 96.18 percent)--i.e., the racial mixture in the school the pupil attended really made a difference in the per pupil expenditures for kindergarten. Some were delivered in a countercompensatory

direction--playground area, teacher vacancies, music expenditures, capacity utilization (Column 5). The average decline in playground footage between a 100 percent Black school and a 100 percent non-Black school was 55 percent of the average footage; and the increase in teacher vacancies between the two extremes was 57 percent of the average number of vacancies--that is, students in mostly Black schools had significantly smaller playgrounds and significantly more vacant teacher positions. Teacher and principal quality characteristics, where significant, were inferior (in terms of *a priori* expectations, though not necessarily in terms of impact on educational achievement) in schools with higher proportions of Blacks (Column 5). Teachers in these schools had significantly less education, came out of significantly lower-rated undergraduate colleges, and had significantly poorer scores on the National Teacher's Examination. Principals in these schools were less experienced.

Funds intended to be compensatory were, in fact, distributed in such manner. The most interesting finding, perhaps, was that Federal funds, though they were clearly distributed in the direction of schools with more Blacks, were distributed with great variability (Column 8). The school climate--the world as it is--was less desirable (on *a priori* grounds) for students in schools with a higher proportion of Blacks--fewer high achievers, more low achievers, more disruptive incidents (Column 5).

For low-income students (Table II), neutrally intended items were close to being neutrally distributed, overall (Columns 4 and 5). Apart from teacher and principal quality characteristics, resources were

distributed with a somewhat compensatory bias. However, these labor inputs were distributed in a distinctly countercompensatory direction. Though something closer to 100 percent of the proportion of variation in Federal funds distribution should have been attributable to variation in the density of low-income pupils, this was not the case. Less than 17 percent were (Column 8, FEDFUNDS). Students in schools with a 100 percent low-income population compared with students in schools with no low-income pupils received 75 percent more than the Federal funds average (Column 7, 174.12 percent)--but the variation was great. Finally, where there were more low-income pupils there were more undesirable school climate conditions.

Junior High Schools. (Detailed findings are in Tables III and IV.) At this level of schooling neutrally-intended resources were distributed with somewhat of a countercompensatory bias with respect to Black students (Table III). Where there were more Black students, teachers faced smaller classes (Column 4)--but the teachers were from significantly poorer schools, scored significantly worse in their National Teacher's Examination, and had significantly fewer credits beyond the B. A. (Column 5). Further, the principals were less experienced and the proportion of teacher vacancies greater. Compensatory expenditures, apart from Federal funds, were allocated in a compensatory fashion--but, remarkably enough, no more Federal funds went to schools with high proportions of Blacks than low proportion ($R^2 < .010$). The relevant coefficient was, in fact, negative!

The allocation of resources from the point of view of the distribution of low-income junior high school pupils (Table IV) was

similarly somewhat biased in a countercompensatory manner. Where there were more low-income students, teacher vacancies were greater, teacher qualifications poorer, and laboratories were more crowded (Column 5)--though the pupil/teacher ratio was lower (Column 4). The most disturbing finding, perhaps, is that, at the junior high school level, none of the variations from school to school in Federal funds per pupil is related to the variation from school to school in the proportion of low-income pupils ($R^2 < .010$).

As in the case of elementary school students, concentrations of Black and low-income pupils were clearly associated with certain peer group characteristics--the proportion of high-scoring students was very significantly higher in schools with fewer disadvantaged, and the proportion of low-scoring students was significantly lower. Contrary to general belief, the concentrations were not associated in a statistically significant way, with (Column 5 in Tables III and IV) disruption in the schools, poorer attendance, or older schools (DATE).

Senior High Schools. (Detailed findings are in Tables V and VI.) At the senior high level, the most neutral distribution of neutrally intended resources appears to have occurred. The fact that the high schools draw from much larger geographical areas and, in several cases, from all over the city--therefore, resulting in more heterogeneous students populations--probably accounts for the more neutral distribution. There were proportionately more teacher vacancies in schools with more disadvantaged, and the condition of the buildings were worse, (Column 5 in Tables V and VI). But the qualities of

the principals, as well as the rest of the resources, did not vary, in a significant way, with the proportion of disadvantaged. Students in schools with high proportions of Blacks had less experienced teachers, but the range was narrow--being in an all Black senior high school meant that the average teacher experience was 1.36 years less (Column 6, Table V) than being in an all non-Black school. Students in schools with high proportions of low-income pupils had teachers with less education, but, again, the range was narrow--being in an all low-income school meant that the average teacher's education was about 10 credits less (32 percent of a 30 credit step) than being in a school with no low-income pupils (Column 6, Table VI).

Compensatory funds did go to the disadvantaged and, at the senior high level, Federal funds did go clearly to the schools with higher proportions of low-income students, 45.7 percent of the variations was "explained" (Column 8). Further, being in a high school with 100 percent low-income, compared to being in a school with no low-income students, meant receiving additional Federal funds equal to almost twice the average amount of Federal funds.

Students in senior high schools with large numbers of disadvantaged were--unliked elementary and junior high school students--in schools that were significantly older (DATE) and had significantly lower attendance rates, and, as in the elementary schools, there were significantly more disruptive incidents where there were more disadvantaged students.

Summary. The statistical results suggests that, in 1970-71, the interschool distribution of resources in Philadelphia had these

general characteristics: (1) The examination scores, education, and quality of undergraduate education were higher for teachers in schools with fewer Blacks and low-income pupils, though this was less significant for senior high schools. (2) The proportion of teacher vacancies was higher for all levels of schooling, where there were more disadvantaged students. (3) Students in elementary and junior high schools with higher proportions of Black pupils had a lower ratio of pupils to teacher, very likely due to the greater amount of compensatory education. (4) State and local compensatory funds were most strongly directed to the Black and low-income student population at the senior high level. (5) Federal funds went somewhat to the low-income concentrations at the elementary school level, not at all at the junior high school level, and clearly so (but not altogether so) at the senior high level. (6) Schools with high proportions of low-income and Black pupils tended to be characterized by student bodies with fewer high achievers, more low achievers, older buildings, poorer attendance, and somewhat more disruption--though these findings were not uniform for all disadvantaged students at all levels of schooling.

CONCLUSIONS

What we have tried to do is to recommend and detail a procedure for investigating intradistrict distributions of educational resources. What we conclude is this:

1. When plaintiffs use aggregate and few measurements (per pupil expenditures, for example), defendants and the courts will have little difficulty in establishing that "legitimate" differences

among schools exist--that is, that differences arising from reasons other than racial or income discrimination will necessarily result in differences in an aggregate measure. Therefore, we urge looking at a much more detailed breakdown of resources, and looking at physical units where possible.

2. No matter how fine the resource breakdown, and no matter how many resources are measured in physical units, there is no conclusive proof that any particular pattern of resource distribution is synonymous with the goal of equality of educational opportunity. What can be proven by such a resource analysis is the extent to which the allocation matches fiat--the avowed policies of allocation. (In Philadelphia, the avowed policy of delivering most Federal funds to schools with the most poor students was not carried out in the junior high schools--the R^2 was close to zero and the t-statistic was not significant.)

3. If unequal resource allocations are found, then distinction needs to be made as to the source of the fiat. School boards, school administrators, teacher unions (leader? members?), parent pressure groups, and state Board of Education are all fiat makers when it comes to the allocation of educational resources. When resources are examined in fine detail, the different decisions makers can be more clearly isolated. It seems appropriate to us that plaintiffs should be attacking more than just local school boards. "Better" teachers will be in "better" schools, as long as union contracts allow for no wage discrimination among different schools. Suing a school administration, alone, for the consequences flowing from this--more teacher vacancies,

better educated teachers in schools with more disadvantaged--seems somewhat narrow in aim. (The Philadelphia School District alone, however, was responsible for not adequately distributing the Federal funds to the junior high schools with low-income students.)

4. Finally, what is clearly needed is matching well-defined objectives of a school system--students of all environmental and genetic backgrounds should receive equal school inputs or students with disadvantaged backgrounds should receive more of the school inputs which can be shown to be productive for them in terms of some target growth in achievement or the brightest students should receive the best inputs because the marginal productivity per dollar will be the highest--with well-defined evidence of which school inputs count for which type of student. Until this is done, educational equity debates will result in unproductive outcomes.

In essence, Hobson v. Hansen did little to further the cause of intradistrict equality of educational opportunity, other than to raise the question. The courts would do well to stay away from these issues unless local school resource allocations are examined in great detail and are matched clearly with the objectives and the entities setting them.

SYMBOLS USED IN TABLES

PUPCOST	Total cost per pupil (dollars).
SALARY	Instructional salary cost per pupil (dollars).
KINDER	Expenditure per pupil on kindergarten (dollars).
GRADE 6	Expenditure per pupil on basic skills, Grade 6 (dollars).
GRADE 5	Expenditure per pupil on basic skills, Grade 5 (dollars).
GRADE 4	Expenditure per pupil on basic skills, Grade 4 (dollars).
GRADES 1-3	Expenditure per pupil on basic skills, Grades 1-3 (dollars).
LIBRARY	Expenditure per pupil on libraries (dollars).
ART	Expenditure per pupil on art (dollars).
MUSIC	Expenditure per pupil on music (dollars).
HEALTH	Expenditure per pupil on health and physical education (dollars).
REMEDIAL	Expenditure per pupil on remedial education (dollars).
PLANT	Expenditure per pupil on plant operation and maintenance (dollars).
COUNSEL	Expenditure per pupil on counselling (dollars).
CLERICAL	Expenditure per pupil on supervision and clerical (dollars).
IMPROVE	Total expenditure on Educational Improvement Program (dollars).
CONDITION	Condition of main building (scale is from 0, worst, to 4, excellent).
DATE	Year in which school was built.
PUPRATIO	Number of pupils per teacher.
NONTEACH	Number of pupils per non-teacher professional.

% VACANT	Percentage of teacher vacancies.
% ATTEND	Average daily attendance (percentage).
% HIGH	Proportion of pupils above 85th percentile in Iowas.
% LOW	Proportion of pupils below 16th percentile in Iowas.
DISRUPT	Number of disruptive incidents per year.
CAPACITYA	Number of students attending ÷ pupil capacity (percentage).
LABS, EN	Number of enrolled students per lab.
LABS, AT	Number of attending students per lab.
FEDFUNDS	Total expenditures per pupil from Federal funds (dollars).
EXPTEACH	Average Step number (related to years of experience) of teachers.
EXAMTEACH	Average score of teachers in National Teacher's Examination, Common.
EDUCTEACH	Average education of teachers (1 for B. A., 2 for M. A., 3 for M. A. + 30, 4 for Ph. D.).
SCHOOLTEA	Average Gourman rating of undergraduate school teachers attended (on a scale from 267 to 770 for Harvard).
DEGREES, P	Number of degrees above B. A. of principal.
EXPER, P	Number of years of experience of principal.
CREDITS, P	Number of additional credits above M. A. + 15 of principal (1 for 15-29, 2 for 30-44, etc.).
BOOKS	Number of library books per pupil.
PLAY	Playground square footage per pupil.